The LSD

(Lightweight, Sturdy Discone)

An Omnidirectional Multiband VHF/UHF Antenna

BY PAUL H. BOCK, JR., K4MSG

THE average v.h.f. operator desiring omnidirectional coverage for equipment testing or local net operation has a variety of antenna types from which to choose. Unfortunately, the more common types, such as the ground plane, whip, coaxial vertical, halo, etc., are relatively narrowband devices; hence, the multiband operator must erect an antenna for each band on which omnidirectional coverage is desired. Despite the fact that these antennas are relatively small, and therefore do not usually create space problems, the amount of feedline required can become excessive unless the antennas are remotely switched with a suitable coaxial relay. While less expensive than multiple cables, this solution also costs money, and the end result may not justify the expense if the antennas are only put to use occasionally.

The Discone

One method of solving this problem is to erect a broadband omnidirectional radiator capable of covering several bands. The LSD (*L*ightweight *S*turdy *D*iscone) is such a radiator. It is relatively small, lightweight, omnidirectional, vertically polarized, and has a 50-ohm feedpoint impedance. As shown in fig. 1, the discone is nothing more than a disc mounted on (and insulated from) the apex of an upright cone. The slant height of the cone, D, is equal to a free-space quarter wavelength at the lowest operating frequency; this frequency is referred to as the *design* frequency, f_0. The base diameter is also equal to D, while the diameter of the disc is somewhat smaller, being equal to $0.7D$.

At a point approximately 20% below the design frequency, termed the *cutoff* frequency, the v.s.w.r. of a discone will rise very sharply to a high value. At frequencies above the design frequency the v.s.w.r. will generally remain below 1.6 until the upper bandwidth limit of the antenna is reached, the theoretical limit being $8f_0$. Thus, the discone appears to the feedline to be a properly terminated high-pass filter over its theoretical bandwidth. Although it is possible that the theoretical bandwidth may not be reached in practice, a bandwidth of $6f_0$ should be easily

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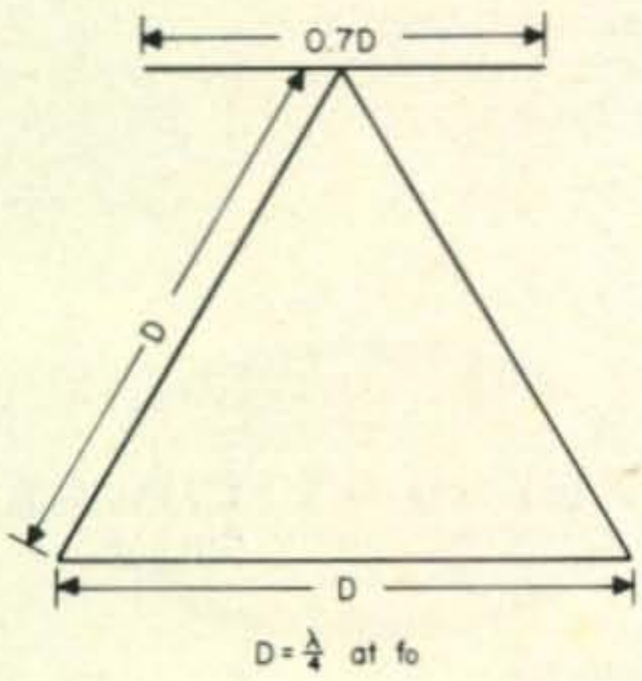

Fig. 1—Basic discone configuration.

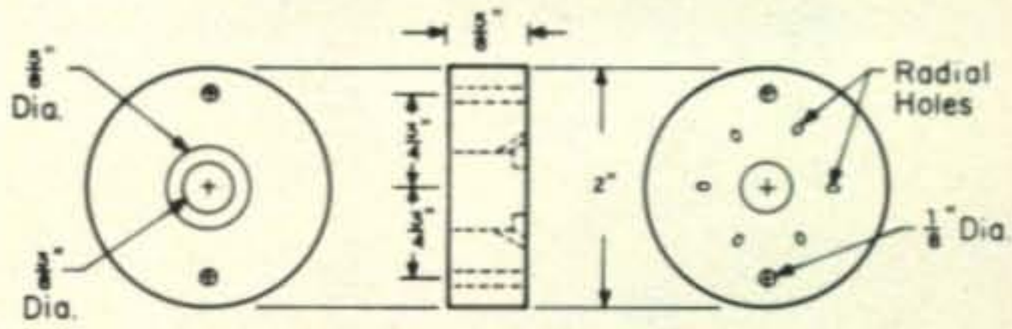

Fig. 2 — Main base mounting plate. Holes for radials are spaced 60 degrees apart on a 1" dia. circle, and tapped 6-32. Holes are drilled at an angle of 60 degrees to the surface of the plate (30 degrees to the vertical axis).

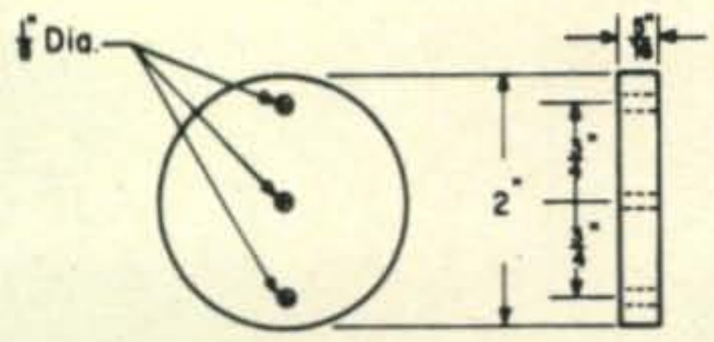

Fig. 3—Insulating disc. For low power operation most insulating materials are adequate, including even wood boiled in paraffin, at lower frequencies. At higher power and frequencies, materials such as Teflon or Nylon are recommended.

achieved using any reasonable amount of care in construction. Single discones could then be constructed for 50/144/220, 144/220/432, 220/432/1296, or 432/1296/2300.

Construction

The basic construction of the component parts is shown in fig. 2, 3, and 4, with the complete structure shown in fig. 5. The author has attempted to include sufficient information to permit duplication; in addition, there are a few basic points which must be observed if the antenna is to operate "as advertised":

(1) Both the disc and the cone can be constructed of sheet metal, or formed with a skeleton of rods. If rods are used, the minimum number for effective operation is 6, with 8 or more being preferable.

(2) The sides of the cone must form an angle of 30° with the *vertical centerline.*

(3) The apex of the cone should be located precisely at the center of the disc.

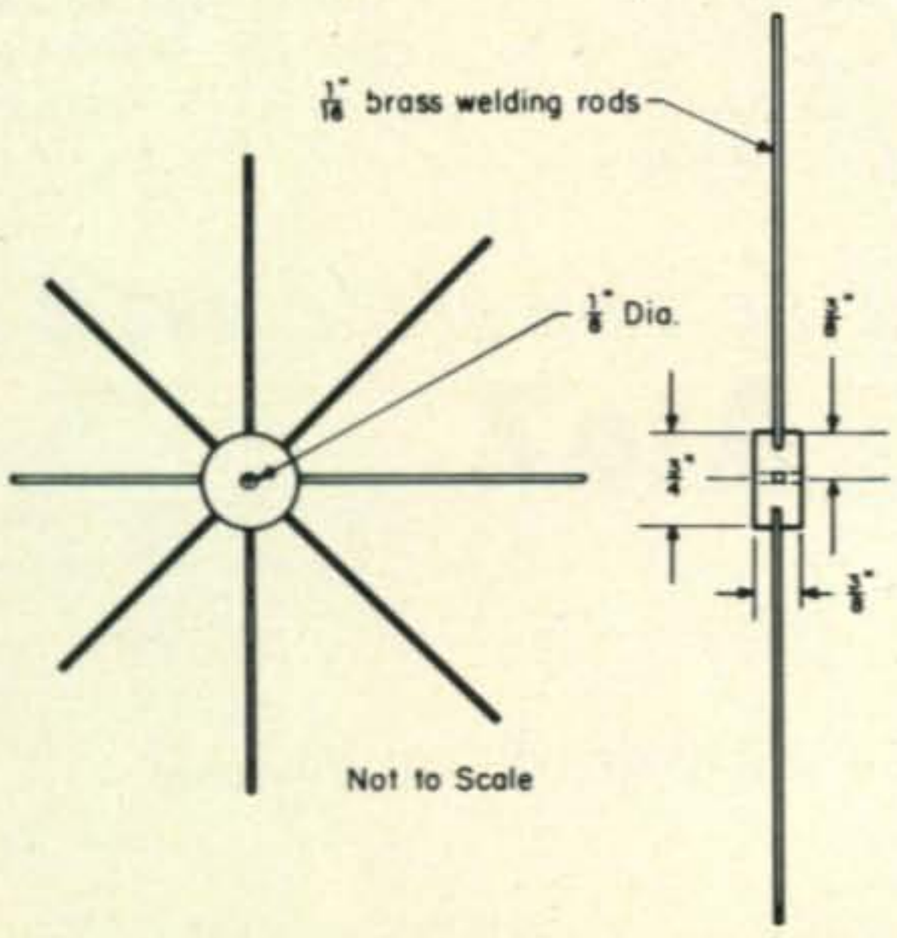

Fig. 4—Disc element. The disc hub is made from a 1/4" section of 3/4" dia. brass rod. Radials are 1/16" brass welding rod soldered to the hub. At the higher bands, a solid brass or aluminum sheet disc element would be more convenient to construct.

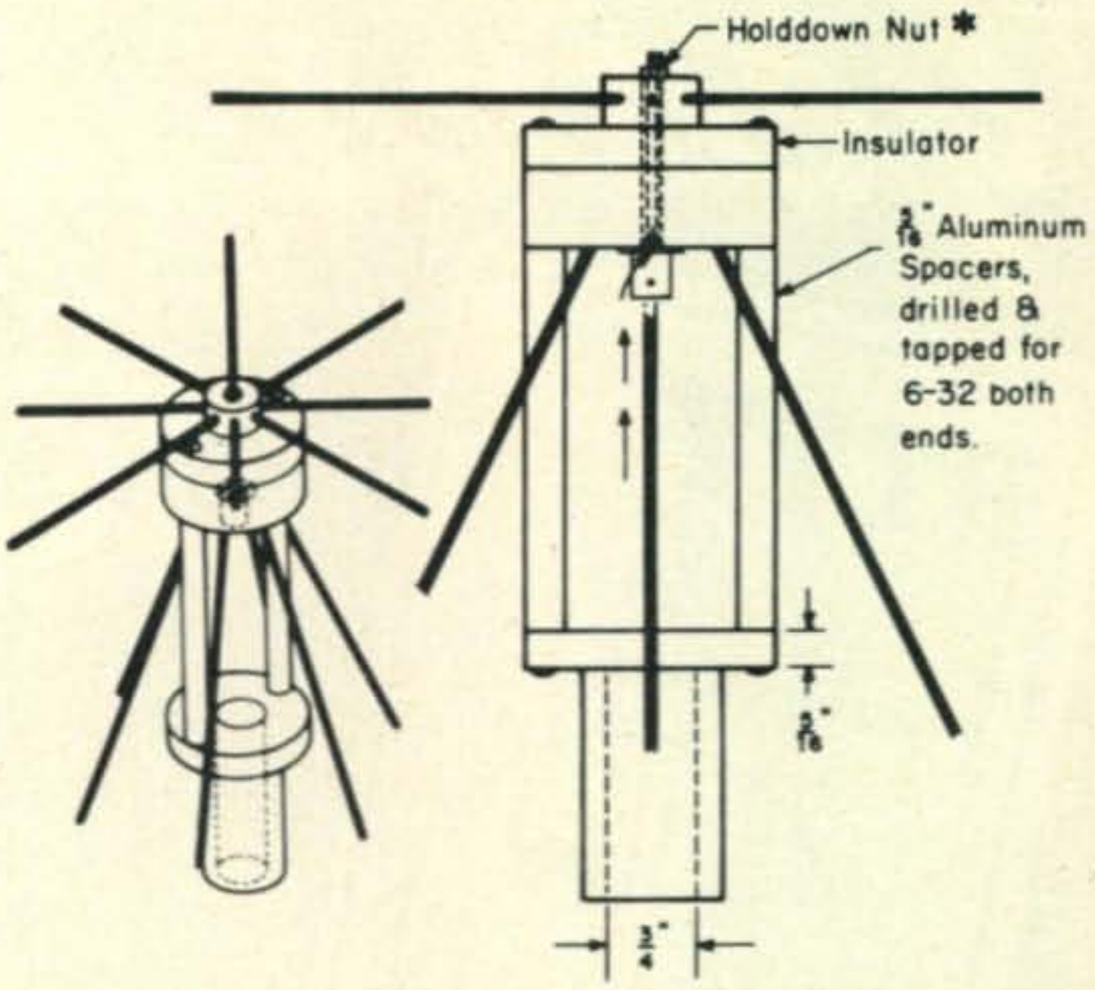

Fig. 5—The complete LSD discone assembly. An aluminum pedestal mounted on two 5/16" dia. spacers fits inside 1 1/8" aluminum tubing used as a mast. The coaxial feedline may be run inside the mast. The holddown nut fastening the disc element to the cone threads onto a 6-32 brass screw soldered to the center terminal of the BNC connector.

Actual construction is not too difficult. The author used a lathe to form some of the metal parts, but substitutions can be made readily and all holes drilled with a hand drill. The cone radials were made from 1/8-inch aluminum welding rod and threaded with a 6-32 die. The base holes were drilled by hand, using a carpenter's protracter to line up the drill at a 30° angle "by eye," and the holes were then tapped to accept the rods. The rods could just as easily be inserted vertically and then bent outward to the proper angle.

The author's version of the disc element consisted of 1/16-inch brass welding rod soldered radially to a quarter-inch length of 3/4" dia. brass rod, as shown in fig. 4. On the higher bands (220 and above), a solid disc cut from aluminum or brass sheet is simpler and more effective.

A type BNC connector was used in the version described, but if power levels over 100 watts are contemplated a type N connector should be substituted. In this case, the base should be a bit larger and the height of the disc adjusted to put it at the proper point. In the event that high power is used, it might be well to fill the hole around the connector with a good potting compound to make it weatherproof and prevent arc-over. The disc

[*Continued on page 76*]

ends of RX's and all in each other's hair. DX heard: W0AIH (several times), ZM1MQ, DJ6I?? GM3IGW/A and HS5ABD supposed to be on with elaborate antennae weren't heard. *W4BRB/VP7:* Oh! That big, fat 10 points for every W. It's better'n being on relief! (You sure did surprise us from getting on from the Bahamas, Gene. Reciprocal licensing between W/VP7 went into effect just a day before the contest. Gene made several hurried phone calls to VP7 officials, was given permission, hopped a plane, set up an antenna and gear and there we were with a VP7 in the contest – *ed.*). *PY2BJH:* Condx were horrible during the test... S9 plus 10 db noise level. Heard W0AIH, W8ANO and W9EWC. Called them but no results. Unfortunately there's only negligible activity on 160 in South America. (Congrats in getting those other PY's on, Hercilio—*ed.*). *PJ2VD:* It was a pleasure to take part in the contest. Think I made a better score than you did at PJ0CW. QRN wasn't like you experienced at Coral Cliff. Think I should be fully satisfied with this result but I am not ...mainly because I couldn't reach Europe in spite of the fact that I heard and called PA0PN for more than an hour, DL9KRA, OK2BOB, EI9J, lots of G's and a GD, GW and HB. Think the solution would be another antenna but the present one (inverted Vee half wave) is the best possible I can make. Anyway, the Rx, a 75A-4 which I just recently got hold of, proved to be a good one. Now making things ready for the coming ARRL c.w. Contest. *OL4AMU:* I send you my results of the *CQ* 160 Meter Contest. I please you excuse me. I send you not the summary calculation because I have not the regulations of this calculation. I am YL and I am 16 years. With sincere amateur greetings, 73! Your Nana. (Of all the Czech logs received this one was the only one to list any comment.—*ed.*). *EI9J:* Skip didn't move beyond W8 while I was on except for W9UCW and W5RTQ. W QRM was fierce at times. Old age creeping up meant that I slept for a considerable time while band was open to W. Worked all the countries I heard. Don't know how I missed out hearing PJ2VD. VP9GJ was missed. Worked him with his G call of G3PQA. *G2DC:* Finally hooked OE1KU after three previous attempts had been wrecked by QRM. *G3XTT:* Enjoyed the contest very much and look forward to future 160 meter WW contests. *OH9NV:* Sorry I couldn't get up a dipole for the contest. Just changing QTH so all ham gear was packed. *DL9KRA:* Thanks for another big event. Everything went smoothly – spares, tubes, tools and soldering guns spread out all over shack but not needed. Condx first morning excellent although HR2HH and PJ2VD not heard. Heard W4BRB/VP7 but no go. Missed out on OH0. Pity that QRL kept 9X5SP from coming on. (If he had been able to show up, Jan, we'd have had all continents on for the test for the first time ever—*ed.*). Big thing was working W5RTQ in Texas. No W6/7 heard. Second morning rather disappointing. Am sitting in Anchorage, Alaska (Jan is a Navigator for Lufthansa). Mailing deadline today.

LSD Discone [*from page 24*]

insulator should be made of Nylon or Teflon unless you plan to run very low power (50 watts or less), in which case anything can be used, even wood boiled in paraffin.

Performance

Although comprehensive gain testing was not conducted, a few measurements were made on a 220-1296 mc model using a remote signal source and a vertical dipole for comparison. Due to the very low-angle radiation characterists of the LSD, some improvement over the dipole was noted, and the degree of improvement was virtually constant for the 220 and 432 mc bands (separate dipoles were used for each band). This is indicative of the flat response a discone provides.

The low-angle radiation characteristics, wide frequency response, and ease of construction should make the discone an inexpensive and useful adjunct to any v.h.f. station. ■

Oscar News [*from page 49*]

on the 10-meter beacon after the second orbit, the mission was entirely satisfactory. The correct orbit was achieved, the stabilization system performed outstandingly, accurate telemetry data was received, the command system operated reliably, useful scientific data has been obtained, and perhaps most important, amateur radio has again demonstrated that it is seriously in the space age.

Future OSCAR Satellites

The door is still wide open for the next satellite in the OSCAR series, which will be called A-O-B until launch, and OSCAR 6 once it is successfully in orbit.

AMSAT is giving serious consideration to a single satellite containing both an f.m. channelized repeater and a linear repeater. Plans call for the f.m. repeater to use a group of uplink channels near 146 mc and a group of downlink channels in the vicinity of 432 mc. The linear amplifier would use an uplink band near 432 mc and a downlink band just below 146 mc.

The satellite would also contain telemetry transmitters operating in the 144 and 432 mc bands.

British, German and Australian radio amateurs are also giving serious thought to various versions of what may become future OSCAR satellites.

In the meantime, AMSAT emphasizes that new ideas are still being considered for OSCAR 6, and prospective participants are encouraged to submit technical proposals for consideration directly to AMSAT, P.O. Box 27, Washington, D.C. 20044. ■

Drake SPR-4 [*from page 29*]

dial may be indexed for calibration by slipping the skirt at the knob.